recent Government grant of 500,000*l.*—a sum, however, which is less than half what is required to put the pensions of the senior members of the university staffs upon a satisfactory footing. In addition, the Carnegie Foundation will continue to provide retiring allowances on the same non-contributory basis to a certain number of old and distinguished teachers. Next, in the British system there is no specific provision for widows or orphans, nor is there provision for disability such as has been instituted by the Carnegie Foundation "for the teacher who, despite his own foresight and self-denial, finds himself and his family the victims of disease or of accident." The reserve accumulated to meet such claims is now 220,000 dollars.

Further, the American scheme is administered from within, as opposed to the Federated System, which is worked through insurance companies. In consequence, there is economy in administrative and other expenses. Insurance companies are not philanthropic institutions. Mr. Fisher, President of the Board of Education, on the second reading of the School Teachers (Superannuation) Bill, 1918, was aware of this when he stated that if the Act were worked through insurance companies there would be the objection that public money was going in dividends to the shareholders of these companies. This is precisely what is happening in the Federated Superannuation System to-day. The Teachers' Insurance and Annuity Association furnishes policies better suited to the teacher's needs, and at lower cost, than companies operating on a commercial basis.

The report contains a mass of interesting matter relating to pensions and pension schemes, including arguments, by no means convincing, in favour of contributory schemes as opposed to non-contributory.

Lord Rayleigh's Scientific Papers.

Scientific Papers. By Prof. John William Strutt. Vol. vi., 1911–19. Pp. xvi+718. (Cambridge: At the University Press, 1920.) 50*s.* net.

THE sixth[1] volume of Lord Rayleigh's collected works, just issued by the Cambridge University Press, contains his papers, nearly one hundred in number, published between 1911 and his death in 1919. In fact, the last two papers, Nos. 445 and 446, of the whole series were left ready for publication, but had not appeared when he died, while the concluding paragraphs of No. 444, on "The Travelling Cyclone," were dictated by him only five days before his death on June 30. He was happy in being able to continue his work until so near the end, and in his fifty years of active scientific life to achieve so much.

The papers in the volume range over a wide list of subjects, and while none of them have the importance of some of those appearing in earlier volumes—*e.g.* the series on the fundamental units of electrical measurements, or the publications describing his work on gases and the discovery of argon—they are marked, as ever, by his power of clear thinking, his grasp of first principles, and his ability to appreciate the essentials of any problem which appealed to him. Some three or four of the articles were contributed to the discussions of the Advisory Committee for Aeronautics, over which he presided for ten years. Among these may be specially mentioned No. 389, the note on the formula for the gradient wind, in which the formula connecting the velocity of the wind, the barometric pressure, the latitude, and the rotation of the earth, which had been employed by Gold and other meteorologists, is derived, assuming the motion in two dimensions, from hydrodynamical principles. The paper No. 444, already mentioned, on "The Travelling Cyclone," though not formally communicated to the Committee, arose out of its discussions.

There are also some notes and reviews communicated to NATURE, but most of the other articles appeared in the *Philosophical Magazine.* Hydrodynamics, optics, and acoustics form the subject-matter of many—problems of vibrations in the solution of which the methods developed in the theory of sound or in some of his earlier optical work are employed with success. Of recent years he returned to a number of optical problems which in earlier days had interested him, and advanced our knowledge by his work. Among these papers may be mentioned several on the scattering of light by small particles. The problem was discussed in the well-known paper on "The Blue of the Sky," published in 1871, and in 1918 Lord Rayleigh gave the complete solution for a sphere in which the structure is symmetrical, but periodically variable, along the radius, while a further paper—*Phil. Mag.*, vol. xxxv.—discussed the case of the scattering of light by a cloud of similar small particles of any shape oriented at random. He was led to investigate the question by the results of his eldest son's experiments on light scattered by carefully filtered gases.

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[1] A notice of vol. v. appeared in NATURE for October 28, 1913. The other volumes were reviewed at an earlier date.

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One of the papers communicated to the Advisory Committee for Aeronautics deals with the analogy between the conduction of heat from a surface and the transfer of momentum in a viscous fluid flowing over the surface. Lord Rayleigh shows that the analogy, which holds so long as the motion is laminar, breaks down when it becomes turbulent. A letter to Prof. Nernst, dated October, 1911, is of rather special interest, though there is nothing in the later pages of the volume to indicate whether or not Lord Rayleigh continued to hold the same opinion to the end. He is discussing some of the difficulties which attend the kinetic theory of gases, and writes :—

> "Perhaps this failure might be invoked in support of the views of Planck and his school that the laws of dynamics (as hitherto understood) cannot be applied to the smallest parts of bodies. But I must confess that I do not like this solution of the puzzle. Of course, I have nothing to say against following out the consequences of the [quantum] theory of energy—a procedure which has already, in the hands of able men, led to some interesting conclusions. But I have a difficulty in accepting it as a picture of what actually takes place."

A paper in the *Philosophical Magazine* for 1919 of somewhat greater length than the majority of those in the present volume deals with the optical character of some brilliant animal colours. The question whether the colours displayed by various birds, by butterflies, and by beetles are structure colours more or less like those of thin plates or are due to surface or quasi-metallic reflection is discussed, and the conclusion reached by Lord Rayleigh is thus stated :—

> "The impression left on my mind is that the phenomena cannot plausibly be explained as due to surface colour, which in my experience is always less saturated than the transmission colour, and that, on the other hand, the interference theory presents no particular difficulty unless it be that of finding sufficient room within the thickness of the cuticle."

In the paper a reference is made to the drawings and conclusions of the Hon. H. Onslow, some of which have since been published.

It is not necessary to add more, or to attempt to give a full account of the contents of the volume under review; there is interest to be found in every page, and throughout it is marked by the characteristics of Lord Rayleigh's writings. He is to be commemorated by a tablet and inscription in the Abbey; the six volumes of his collected works form his true memorial, built by himself, to live so long as there are students of physical science to read and learn the truths which they contain.

The volume has been edited by his son, the present Lord Rayleigh, with the help of Mr. W. F. Sedgwick. It is published by the Cambridge University Press in its usual admirable style, and concludes with a classified table of contents of the whole of the six volumes. The list, occupying some forty pages, shows in a remarkable way the extent of ground covered by Lord Rayleigh's contributions to physical science.

Studies of British Mammals.

Habits and Characters of British Wild Animals. By H. Mortimer Batten. Pp. 346. (London and Edinburgh: W. and R. Chambers, Ltd., 1920.) 21*s*. net.

THERE are several trustworthy and readily available books on British mammals, such as Lydekker's and Sir H. H. Johnston's, not to speak of the expensive volumes of Millais and others, but there is a distinctiveness in Mr. Mortimer Batten's studies which makes them welcome. They have a broad basis of personal observation, they give prominence to habits, and they try to get at the character of the creatures. The book is written in excellent style; it smacks of the open country, and it is packed with interesting information without being overloaded. The very artistic illustrations by Mr. Warwick Reynolds appeal to us as revealing the temperament of the animals portrayed and also as pictures, *e.g.* the charming coloured frontispiece of roe-deer jumping up at rowan berries.

Mr. Mortimer Batten deals with red deer, roe-deer, fox, weasel, stoat, otter, pine-marten, badger, polecat, brown hare, mountain hare, rabbit, hedgehog, squirrel, brown rat, water-vole, and wild cat. Without rigidly adhering to any scheme, he discusses range, feeding habits, breeding, struggle for existence, interrelations, general characteristics, size, weight, and last, not least, the disposition or character. We wish that, when he was at it, he had completed his survey of British mammals so that his excellent book might have been a comprehensive unity. A second edition should remedy this. We do not mean that there need be any treatment of the Orkney vole and that sort of thing, but we miss the little gentleman in the velvet coat; we should like to have seen the book representative of all the short list of British mammals. We must protest, of course, against the usage which calls this a book on British wild *animals*.

We have found Mr. Mortimer Batten's studies full of interest, and we have a lively appreciation of their originality and independence. Sometimes, we confess, his theoretical interpretations

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